



# Can You Hear Me Now?

## Managing the Electromagnetic Spectrum

By the DON CIO Spectrum Team

*It is clear that spectrum is a key component in achieving information dominance for future U.S. military operations. The DON spectrum management process, if adhered to, will greatly enhance the warfighter's ability to have seamless and transparent access to spectrum's extraordinary capabilities for transmitting information.*

The 22-screen multiplex cinema down the street from Ray Willis' office in Alexandria, Va., does a brisk business on most days, but Ray rarely has time to catch Hollywood's hottest new flicks. He and his colleagues are too busy working on a blockbuster of their own that has real-world implications for Department of the Navy (DON) warfighters afloat and ashore.

Ray is part of a team of dedicated professionals at the Navy and Marine Corps Spectrum Center (NMSC), formerly NAVEMSCEN, focused on managing the DON's use of the electromagnetic spectrum — a class of radio waves propagated by a system of electric and magnetic fields that include the full range of radiant energy from radio and light waves to gamma and cosmic rays. Atmospheric interaction with these waves provides characteristics that can be harnessed, using electronic systems and devices, to transmit information.

Supporting the management and use of the radio spectrum from the NMSC perspective means planning and coordinating joint use of required frequencies through operational, engineering and administrative procedures. The objective is to enable DON spectrum-dependent systems and devices, such as radios that support voice communications or digital data links, Global Positioning Systems, and systems for detecting and suppressing enemy radar and communication sites, to perform their functions in the intended environments without causing or suffering, unacceptable interference.

Spectrum management is a high-stakes proposition. DON command and control centers are afloat assets with no direct access to commercial or military communications systems via landline, which puts

commanders in the position of being solely dependent upon wireless technologies that use spectrum to perform mission-essential tasks. Comprehensive spectrum coordination in this environment is more than just good policy — it is crucial to the DON's ability to remain highly maneuverable, flexible and tactically effective.

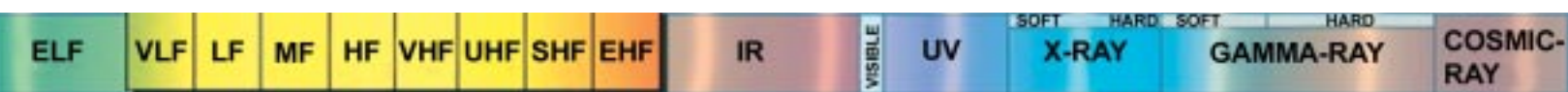
### Spectrum's Crowded Neighborhood

An NMSC spectrum certification engineer, Ray Willis has devoted more than 15 years of his career to managing and supporting United States military spectrum activities. In that time, he has seen up-close the extraordinary growth in the number of military and commercial systems and devices using spectrum, from high-powered mobile radar and ship/air early warning systems to cellular telephones and personal communication system (PCS) devices such as Blackberries.

"The biggest change I've seen is that, coincident with the rapid technological advances in spectrum usage, the critical importance of spectrum in mission performance has become more and more evident," said Willis. "You see it talked about everywhere. At congressional levels, at the FCC."

Like rapidly expanding suburbs near large cities, however, the crowded spectrum neighborhood is vulnerable to its own traffic jams. When individuals and organizations forget or ignore the necessary basics for operating a piece of equipment harmoniously in the electromagnetic spectrum with its finite number of frequencies, there can be serious consequences.

"The fact is you want the piece of equipment to successfully operate to achieve the



desired mission. You want to be able to turn it on," said Willis. "But there have been cases where people purchased something and we determined later on it couldn't be used in that [frequency] band. When equipment is acquired without considering the rules and regulations governing its use, or the necessary process for securing the required authorization, then the user has just bought himself a big paperweight because he cannot legally use the equipment."

The NMSC-led "process" is a key part of the DON's approach to managing the electromagnetic spectrum and ensuring its spectrum-dependent equipment can operate successfully and without interference in land, air and sea-based environments. This spectrum management process consists of three basic phases: equipment certification, frequency assignment and host nation approval.

### Phase 1: Equipment Certification

Before a unit decides to purchase or develop equipment that requires use of the spectrum, it must obtain an equipment certification, a "permit to operate," from the National Telecommunications and Information Administration (NTIA) — coordinated through NMSC. The Center reviews the equipment application to ensure it is compliant with spectrum management policy, allocations, regulations and technical standards, and determines whether the radio-frequency spectrum it requires is available. When granted, a certification provides a unit the authority to conceptualize, experiment, develop or operate (and then procure) new spectrum-dependent equipment.

Equipment certification is also where a unit gets its first exposure to the DD Form 1494, Application for Equipment Frequency Allocation. The DD 1494 is the vehicle through which units provide specific technical information to NMSC regarding their spectrum-dependent equipment across all three phases of the spectrum management process.

An increasing number of DD 1494s are arriving at NMSC from units seeking certification to operate commercial-off-the-shelf (COTS) equipment, which is not surprising since more units are purchasing ready-to-use COTS products with military capabilities that can be more cost-effective for the DON. This was the case, for example, with

the Naval Oceanographic Office Network's (NAVO Net) Stennis Space Center headquarters in 1999 when it submitted its DD 1494 for the SmartLink C-Band SATCOM Terminal, a system that proposed using spectrum to provide ship-to-shore connectivity in support of oceanographic survey operations for T-AGS 51 and 60 class ships.

### Phase 2: Frequency Assignment

Once a system or device has completed the equipment certification process, and a letter is produced confirming that the equipment has been certified, the next phase in the spectrum management process begins: obtaining a frequency assignment. In this phase, a unit must submit a frequency assignment proposal. When NMSC receives a frequency proposal request, it must include the nomenclature of the certified equipment that will be used. The granting of a frequency assignment, a license to operate, gives a unit the authority to operate a piece of equipment on a specified frequency, frequencies or frequency band at a specific location and under a specific set of conditions.

The spectrum management process isn't a one-way street, of course. NMSC engineers and telecommunications specialists who are responsible for shepherding DD 1494s through Phase 1 (equipment certification) and Phase 2 (frequency assignment) often contact manufacturers, in the case of COTS products from outside vendors or the units themselves to clarify outstanding questions and issues.

Ray Willis recalls how a back-and-forth consultation between NMSC and one unit helped to resolve a potential pre-assignment frequency interference issue. The DON wanted to install a Dry Dock Flood Alarm System at the Pearl Harbor Naval Shipyard to guard against floods by measuring the harbor water levels.

"This alarm system had the potential for interfering with some systems already operating at the same location," said Willis. "We suggested the unit do an on-site study to confirm whether the new system would create interference. They determined the power was low enough, so it would not. Sometimes we have to do things like that — to assist frequency managers at units when a new frequency is being introduced and encourage them to ask, 'Have we done everything that is necessary to ensure electromagnetic compatibility?'"

### Phase 3: Host Nation Approval

Spectrum management doesn't stop at United States borders. While the DON mission is worldwide, host nations have sovereign rights over the spectrum within their borders. The use of U.S. spectrum-dependent commercial and military systems abroad requires careful coordination and negotiation.

The Host Nation Approval (HNA) phase applies to spectrum-dependent equipment that could be used in a foreign country or its territorial waters. The DD 1494 requires a unit to indicate the geographical area in which a system will operate. This discloses, for example, that systems like NAVO Net's SmartLink C-Band SATCOM Terminal, used in worldwide ocean areas, have the potential for interacting with a foreign government's spectrum policies and regulations. NMSC takes the lead on HNA coordination. Working with the cognizant Combatant Command (COCOM) and/or other U.S. government agencies, it secures approval for the DON to operate its spectrum-dependent equipment outside the United States, which entails obtaining approvals and certifications from host nations.

Coordinating HNA can be time consuming; it can take over a year to receive authorization from a country. Issues that affect the amount of time required include: how the host nation uses the frequencies being requested, equipment certification, output power, and in-country locations and length of time in which equipment will be used.

It is clear that spectrum is a key component in achieving information dominance for future U.S. military operations. The DON spectrum management process, if adhered to, will greatly enhance the warfighter's ability to have seamless and transparent access to spectrum's extraordinary capabilities for transmitting information. For Ray Willis and his NMSC colleagues, that will be better than the best Hollywood ending.

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